REMARKS/ARGUMENTS

Claims 1, 4-18, 33, 34, and 35 are pending in the application. For at least the reasons stated below, Applicants assert that all claims are in condition for allowance.

CLAIM REJECTIONS UNDER 35 U.S.C. § 102

(a) *CLAIMS 1, 4, 5, 8, 14, 33, AND 35* – STROTT

Claims 1, 4, 5, 8, 14, 33, and 35 have been rejected under 35 U.S.C. § 102(b) as being anticipated by *Strott et al.* (U.S. Patent 5,057,811). Because each and every element of every claim is not taught by the reference as required by MPEP § 2131, the Examiner's § 102 rejections are unsupported by the art and should be withdrawn.

The present invention generally provides for a physical property sensor, including the following elements (with element labels added for ease in identifying the recited elements):

(a) a substantially solid insulating sensor body having a front surface and a back surface, and the sensor body having a known thermal conductivity, wherein the sensor body has a plurality of openings extending from the front surface to the back surface;

(b) a plurality of independent sensing elements coupled to the front surface for monitoring the properties of a fluid, the plurality of independent sensing elements including at least one thermal sensor and at least one heater, wherein the thermal conductivity of the sensor body is low enough to substantially prohibit heat transfer between the plurality of independent sensing elements via the sensor body, and wherein the sensor body includes continuous solid material below the plurality of sensing elements thus providing for a more robust sensor die; and

(c) a connection material filling the plurality of openings such that the plurality of independent sensing elements are electrically connected to corresponding connection material on the back surface, and the connection material is configured to accommodate connection of the connection material to an electronics substrate.

Initially, *Strott* describes a temperature switch for use in power controllers to protect against thermal buildup in a power system. More importantly, *Strott* does not deal with physical property sensing. The device described in *Strott* includes an insulating layer 4 and electrically coupled thermistors 3, 12, 13 on the insulating layer. *See* Col. 4, line 23-Col. 5, line 6. By running a current through a nearby shunt 5, thermistor 3 is heated up relative to the other thermistors 12, 13. *See* Col. 5, lines 6-30; Figs. 1, 2. Measuring the temperature/resistance difference between thermistors allows for monitoring thermal buildup and determining when a predetermined level is exceeded. *Id.* In contrast to the present claimed invention, *Strott* only

provides for a binary temperature switch; the switch merely determines whether a temperature differential is either greater than or less than a predetermined level. This switch can not be used for "monitoring the properties of a fluid" as claimed in the present invention.

More specifically, claim 1 of the present invention recites that the plurality of independent sensing elements are coupled to the front surface of the insulating sensor body. *Strott*, in contrast, clearly shows thermistors 3, 12, and 13 on the back surface of insulating layer 4. *See*, Fig. 2. Claim 1 also recites that "the sensor body includes continuous solid material below the plurality of sensing elements..." *Strott*, in contrast shows insulating layer 4 as being clearly above thermistors 3, 12, and 13. *See*, Fig. 2. Moreover, none of the other elements of *Strott* teach the insulating sensor body of the present invention. Whereas claim 1 recites that "the sensor body has a plurality of openings extending from the front surface to the back surface" and that a connection material fills those openings such that "the plurality of independent sensing elements are electrically connected to corresponding connection material on the back surface," *Strott* fails to teach this. None of the other elements of *Strott*, such as elements 2 or 5, have a connection material that fills an opening that extends from the front surface to the back surface thereof. For instance, bumps 9, the elements that are alleged to teach the connection material of the present invention, do not extend through an opening from the front surface to the back surface of elements 2 or 5. *See*, Fig. 2.

Element (b) of claim 1 further recites "wherein the thermal conductivity of the sensor body is low enough to substantially prohibit heat transfer between the plurality of independent sensing elements via the sensor body." Nowhere does *Strott* teach this element or a sensor body "having a known thermal conductivity" as claimed in the present invention. Moreover, MPEP § 2131 requires that for a proper § 102 rejection, "The identical invention must be shown in as complete detail as is contained in the ... claim." (emphasis added). *Strott* clearly does not show this aspect of claim element (b) "in as complete detail" as claimed. For this additional reason, *Strott* fails to teach each and every element of the pending claims.

For at least these reasons, *Strott* clearly does not show each and every element of claims 1, 4, 5, 8, 14, 33, and 35 as required by MPEP § 2131. Accordingly, Applicants respectfully request that the Examiner's § 102 rejection as to these claims be withdrawn.

As to claim 14, which recites that "the substantially solid sensor body is made up of a first material and a second material, wherein the first material is positioned directly below the

plurality of sensing elements," the Examiner states "there are at least two materials, 4, 2 and/or 5." Applicants take the Examiner's statement to mean that the Examiner believes elements 2, 4, and 5 of *Strott* constitute at least "a first material and a second material" of the insulating body, as claimed in the present invention. However, it is unclear which element of *Strott* the Examiner believes teaches the "substantially solid insulating sensor body." Examiner first states that *Strott* teaches "insulating body 4," thereby implying that Examiner believes element 4 of *Strott*—the "second glass electrically insulating layer"—teaches the insulating body of the present invention. But the Examiner subsequently insinuates that elements 2, 4 and 5 of *Strott* teach the insulating body of the present invention. Neither interpretation of *Strott* successfully teaches each and every element of claim 14.

If it is interpreted that element 4 of *Strott* teaches the insulating body of the present invention, then *Strott* does not teach the substantially solid sensor body being "made up of a first material and a second material" as claimed in claim 14 because element 4 is a single material. If it is interpreted that elements 2, 4, and 5 of *Strott* teach the insulating body of the present invention, then *Strott* does not teach a connection material filing a plurality of openings that extend "from the front surface to the back surface" of the insulating body as claimed in claims 1 and 14. *See*, Figs. 1 and 2 (clearly showing bumps 9—the element alleged to teach the connection material of the present invention—extending through "insulating body 4" but not extending through first electrically insulating layer 2 or shunt 5). Either the rejection alleges that the "insulating body" is taught by element 4 of *Strott* and the insulating body is made up of a single material, or the rejection alleges the "insulating body" is taught by elements 2, 4 and 5 and the connection material 9 does not extend therethrough. Both interpretations come up short, and for this additional reason, *Strott* fails to teach each and every element of claim 14.

(b) *CLAIMS 1, 4, 8, 14, 33, AND 35* - MASTROMATTEO

Claims 1, 4, 8, 14, 33 and 35 have been rejected under 35 U.S.C. § 102(e) as being anticipated by *Mastromatteo et al.* (U.S. Patent 6,028,331). Because not every element of every claim is taught by the reference as required by MPEP § 2131, this rejection is inappropriate.

Claim 1 recites "a plurality of independent sensing elements coupled to the front surface" of the sensor body, wherein the sensing elements include "at least one thermal sensor and at least one heater." Figures 12 and 13 of *Mastromatteo* show a cross-section of a wafer of

semiconductor material in the final step of the manufacturing process. *Mastromatteo* discloses a heater 21 proximate to and supported by a intermetallic dielectric layer 15, the layer alleged to teach the sensor body of the present claimed invention. However, the other elements that are alleged to teach the remaining plurality of sensing elements—tin oxide film 24 and sensitive element 25—are not coupled to the front surface of layer 15 as is heater 21. The tin oxide film 24 produces sensitive element 25 to extend over heater 21 and connecting to contacting electrodes 22, thereby producing a connection with contact regions 14c. *See* Figs. 11 and 13; Col. 4, lines 46-53. Tin oxide film 24 and sensitive element 25 are not connected to layer 15. The present claimed invention recites a plurality of sensing elements—including both a thermal sensor and a heater—that are coupled to the front surface of the sensor body. The heater 21 of *Mastromatteo* and the other sensing elements, 24 and 25, are not coupled to the front surface of the same element as claimed by the present invention.

Claim 1 further recites that "the sensor body includes continuous solid material below the plurality of sensing elements." In contrast, *Mastromatteo* states that "the sensitive element 25 and the heater 21 are supported by the dielectric layer 15 and are disposed above the air gap 26, which insulates them thermally from the regions underneath." Col. 4, lines 64-67 (emphasis added), *see, also*, Figs. 12 and 13 (showing the air gap beneath elements 21 and 25). By teaching an air gap below the heater 21 and sensitive element 25, *Mastromatteo* fails to describe the "continuous solid material below the plurality of sensing elements" as claimed in the present invention.

For at least these reasons, *Mastromatteo* fails to teach each and every element of claims 1, 4, 8, 14, 33 and 35 as required by MPEP § 2131.

CLAIM REJECTIONS UNDER 35 U.S.C. § 103

(a) *CLAIMS 1, 4-16, AND 33-35* – BERTRAM AND MORIMASA

Claims 1, 4-16, and 33-35 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Bertram* (U.S. Patent 4,085,398) in view of *Morimasa et al.* (U.S. Patent 5,804,720). The cited references, either alone or in combination, do not teach or suggest all the claim limitations as required by MPEP § 2143, and the references are not properly combinable to teach the claimed invention as required by MPEP § 2143. Therefore, this rejection is inappropriate.

(i) References Fail to Teach or Suggest Connection Material Filling the Plurality of Openings

Claims 1, 4-16, and 33-35 recite "a connection material filling the plurality of openings..." where the plurality of openings extend "from the front surface to the back surface" of the sensor body. *Bertram*, in contrast, fails to teach or suggest this limitation. Rather than filling holes 3, it is clear that plugs 4 only extend partially from the front surface of substrate 2 towards the back surface of substrate 2. *See*, Fig. 2 (showing open space in holes 3 that is not filled by a connection material). This result is logical because, reading *Bertram* as a whole, it is clear that the reference is concerned with connecting wires of different gauges; the different gauges account for the failing to fill holes 3. In other words, holes 3 are not filled with "a connection material" because *Bertram* teaches two elements—plug 4 and lead wire 5—to occupy holes 3, not a "connection material" as claimed in the present invention.

Moreover, *Morimasa* also does not teach these limitations nor does it suggest modifying *Bertram* to teach these limitations. Specifically, *Morimasa* describes resistors 8-10, which are formed on bridge 7, and electrodes 12, which are formed at the end of resistors 8-10 and are the only electrical connection to resistors 8-10. *See* Col. 2, lines 61-64; Figs. 3 and 4. Nothing in *Morimasa* teaches or suggests electrically connecting the plurality of independent sensing elements with a connection material filling a plurality of openings that extend from the front surface of a sensor body to a back surface of a sensor body. Indeed, the only electrical connections to resistors 8-10, namely electrodes 12, lead away from the resistors along the two-dimensional plane of insulation layer 6 or protection layer 11; electrodes 12 clearly do not fill openings that extend from a front side to a back side of flow sensor 1. *See*, Figs. 3 and 4. Accordingly, there is nothing in the description of *Morimasa* that would teach or suggest modifying *Bertram* to include a connection material that fills the plurality of openings as claimed in the present invention.

For at least these reasons, *Bertram* and *Morimasa* fail to establish a *prima facie* case of obviousness for claims 1, 4-16, and 33-35 as described by MPEP § 2143.

(ii) References Fail to Teach or Suggest a Continuous Material Below the Plurality of Sensing Elements

Claims 1, 4-16, and 33-35 further recite a "substantially solid insulating sensor body...wherein the sensor body includes continuous solid material below the plurality of sensing

elements." The references fail to properly teach or suggest this limitation. The *Morimasa* reference clearly teaches a hollow 4 below resistors 8-10, and not a "continuous solid material." *See*, Col. 2, lines 41-64; Fig. 4. Moreover, *Bertram* is not properly combinable with *Morimasa* to teach or suggest this limitation because the hollow 4 of *Morimasa* is integral to the objectives sought to be obtained by the *Morimasa* reference. *See*, Col. 1, lines 51-59. As noted by MPEP § 2143.01, "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious."

Even assuming, *arguendo*, that that the "continuous solid material below the plurality of sensing elements" is taught by *Bertram*, the reference still fails to teach or suggest the "plurality of independent sensing elements" above the "continuous solid material," as claimed in the present invention. Examiner asserts that the claimed invention is disclosed by *Bertram* "except the heater and two thermal sensors." The Examiner goes on to assert that these missing elements are disclosed by *Morimasa*: "The noted arrangement is disclosed at Fig. 4 with sensors 9, 10, and heater 8..." Applicants respectfully disagree with Examiner that these references can be combined so as to incorporate the heater 8 and the sensors 9 and 10 (resistors 8-10) from *Morimasa* into the *Bertram* reference. The resistors 8-10 of *Morimasa* are described by the reference as requiring a hollow 4 below the resistors to achieve the benefits of the disclosure therein. *See*, Col. 1, lines 51-59; Col. 2, lines 41-64; Col. 3, lines 18-23; Fig. 4.

It would therefore be impracticable, and accordingly one skilled in the art would not be motivated to attempt, to modify *Bertram* to incorporate the resistors 8-10 of *Morimasa*. *See*, MPEP § 2141.02 (noting that "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention."). Whereas *Bertram* includes solid substrate 2 and plugs 4 directly below the sensing end of the detector, resistors 8-10 from *Morimasa* require a hollow directly therebelow. Further, the electrical connection to the sensing end of the detector of *Bertram* is plug 4, which extends directly downward from the sensing end; if a hollow were created at the sensing end of the detector of *Bertram* to accommodate for the resistors 8-10 of *Morimasa*, the hollow would be directly below resistors 8-10, thereby leaving no place for plugs 4 to connect to the resistors.

For these additional reasons, *Bertram* and *Morimasa* fail to establish a *prima facie* case of obviousness for claims 1, 4-16, and 33-35 as described by MPEP § 2143.

(iii) References Further Fail to Teach or Suggest the Limitations of Claims 14-16

Claims 14-16 further recite that the sensor body "is made up of a first material and a second material, wherein the first material is positioned directly below the plurality of sensing elements" or that the sensor body "includes a plug made of a first material positioned below the plurality of sensing elements, the plug being surrounded by a second material which makes up the remainder of the substantially solid sensor body." The claims also require that the plurality of independent sensing elements are "coupled to the front surface" of the sensor body. Thus, even if the sensor body is made up of two materials (claims 14-16), the sensing elements are still coupled to the front surface thereof. The Examiner asserts several arguments to support the view that *Bertram* teaches the limitations of claims 14-16. Applicants respectfully disagree that either *Bertram* or *Morimasa*, each alone or in combination, teach or suggest a substantially solid insulating sensor body that is made up of or includes first and second materials as recited by claims 14-16.

The Examiner first asserts that, "In claims 14-16, col. 2, lines 1-5 [of *Bertram*] discloses more than two plugs and holes." The plugs 4 of *Bertram* are not part of the substrate 2 and, therefore, cannot teach or suggest a second material of the substrate. Rather, the plugs 4 are electrically connected to film 8; if the plugs are not interpreted as teaching the connection material that is electrically connected to the plurality of independent sensing elements of the present invention, then *Bertram* clearly fails to teach the connection material claimed by the present invention. Moreover, the present invention recites "a substantially solid insulating sensor body." Plugs 4 cannot teach one of the materials of the insulating sensor body to satisfy claims 14-16 because the material of plugs 4 is clearly not insulating; plugs 4 are metal and conducting. *See*, Col. 2, lines 5-7. For at least these reasons, the plugs 4 do not teach or suggest a second material of the sensor body as suggested by Examiner.

The Examiner further asserts, "Or in claim 14, the insulator 10 and substrate 2 [of *Bertram*] meet the claim as a second and first material, with the first material 2 below the sensing elements." As suggested by the Examiner, substrate 2 of *Bertram* is below the "sensing elements" of *Bertram*, namely thin film 8. However, if deposited film 10 of electrical insulation material is considered to teach part of the "sensor body" of the present claimed invention as suggested by Examiner in order to satisfy claim 14, then the sensing elements would not be "coupled to the front surface" of the sensor body. *See*, Fig. 2 (clearly showing sensing film 8

sandwiched between substrate 2 and deposited film 10). Rather, the sensing elements would be above one material of the sensor body (substrate 2) and below the other material of the sensor body (deposited film 10). Nor would there be any motivation to modify *Bertram* to arrange deposited film 10 below sensing film 8; the very reason for deposited film 10 is protect the sensing film 8, which only works if sensing film 8 is arranged between substrate 2 and film 10. *See*, Col. 3, lines 16-18.

The Examiner also asserts, "Or as another alternative to claims 14-16, the insulator [10 of *Bertram*] is a first material plug, which is depicted as substantially cylindrical within the vias in Fig. 2, thus below the sensing film 8." Firstly, film 10 is not depicted as being within the vias of *Bertram*. *See*, Fig. 2 (showing film 10 above holes 3; meniscus 6 is concavely arranged into plugs 4), *see, also*, Col. 2, lines 19-27, Col. 3, lines 16-18 (describing meniscus 6 is concavely arranged into plugs 4 and film 10 over film 8). Further, for the same reasons stated above, considering the deposited film 10 as being one of the materials that make up the sensor body fails to teach or suggest the present claimed invention; if film 10 is part of the sensor body along with substrate 2, the sensing elements 8 would be inside the sensor body, not "coupled to the front surface" thereof. As described above, film 10 only protects film 8 as taught by *Bertram* if sensing film 8 is arranged between substrate 2 and film 10. Film 8 would not be "coupled to the front surface" of the sensor body as claimed if the sensor body includes both substrate 2 and film 10.

The Examiner finally asserts, "Or, the insulator 10 is below the sensing elements when the device is upside down, such as happens during shipping or handling." If element 10 of *Bertram* is considered to be part of the sensor body and is considered to be below the sensing elements because the device is upside down, then the remainder of the sensor body, substrate 2, would then be above the sensing elements and the sensing elements would be sandwiched therebetween. This arrangement still fails to teach or suggest the present claimed invention for the same reasons discussed above, namely the sensing elements would not be "coupled to the front surface" of the sensor body.

Moreover, there is nothing in *Morimasa* that teaches or suggests modifying *Bertram* to include a sensor body that "is made up of a first material and a second material, wherein the first material is positioned directly below the plurality of sensing elements" or a sensor body that "includes a plug made of a first material positioned below the plurality of sensing elements, the

plug being surrounded by a second material which makes up the remainder of the substantially solid sensor body." To the contrary, *Morimasa* clearly teaches forming a hollow 4 below the sensing elements, not a sensor body of two materials.

For these additional reasons, *Bertram* and *Morimasa* fail to establish a *prima facie* case of obviousness for claims 14-16 as described by MPEP § 2143.

(b) *CLAIMS 17 AND 18* – BERTRAM, MORIMASA, AND GERBLINGER

Claims 17 and 18 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Bertram* with *Morimasa*, further in view of *Gerblinger et al.* (U.S. Patent 5,430,428). Applicants respectfully oppose these rejections. Because the cited references alone or in combination fail to teach or suggest all of the claim limitations as required by MPEP §2143, Applicants respectfully request that the Examiner's §103 rejection as to claims 17 and 18 be withdrawn.

As shown above, the combination of *Bertram* and *Morimasa* fails to teach or suggest a sensor body made up of a first material and a second material (claim 14) or a sensor body that includes a plug made of a first material and being surrounded by a second material which makes up the remainder of the sensor body (claim 15). Claims 17 and 18 depend from claims 14 and 15 respectively and, therefore, also include these limitations. Moreover, *Gerblinger* fails to teach or suggest these limitations or teach or suggest modifying *Bertram* and *Morimasa* to include these limitations.

For at least these reasons, the cited references do not, alone or in combination, teach or suggest all of the claim limitations of claims 17 and 18.

(c) *CLAIM 11, 12, AND 34* - BERTRAM, MORIMASA, AND KUSHIDA

Claims 11, 12, and 34 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Bertram* with *Morimasa*, further in view of *Kushida et al.* (U.S. Patent 4,400,684). Applicants respectfully oppose this rejection. Because the cited references alone or in combination fail to teach or suggest all of the claim limitations as required by MPEP §2143, Applicants respectfully request that the Examiner's §103 rejection as to claims 11, 12, and 34 be withdrawn.

Claims 11, 12, and 34 depend from claim 1, and as shown above, the combination of *Bertram* and *Morimasa* fails to teach or suggest all of the claim limitations of claim 1—such as a

connection material filling the plurality of openings and a substantially solid insulating sensor body below the plurality of sensing elements. Because *Kushida* does not teach or suggest modifying *Bertram* and *Morimasa* to include the missing limitations, combining *Kushida* with *Bertram* and *Morimasa* also fails to teach all of the claim limitations. Accordingly, the cited references do not, alone or in combination, teach or suggest all of the claim limitations of claims 11, 12, and 34.

CONCLUSION

Applicants submit that all pending claims are allowable and respectfully request that a Notice of Allowance be issued in this case. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (612) 607-7386.

If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees including fees for any extension of time, to Deposit Account No. 50-1901 (Reference 9028-322).

Respectfully submitted,

By _____

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